
Clearlake H2S
Clearlake, CA
CAPCOA
May 23, 2011
Image © 2011 GeoEye
Google
Imagery Date: 9/28/2010
1993
38°57'29.63" N 122°37'34.94" W elev 1418 ft
Eye alt 24055 ft

Clearlake H2S

- Clearlake located about 20 miles from geothermal area
- Active geothermal fault zones underlying city of Clearlake
- Ongoing intermittent problems during rainy season, which seals the soils and causes venting of H2S and other gases
- 10 years ago a family house was evacuated and house demolished due to H2S

Hydrogen Sulfide

- Colorless, flammable gas - hazardous
- ID'd easily in low concentrations by rotten egg odor
- Above 100 ppb can lead to olfactory fatigue (OF)
- Prolonged low exposure can lead to same OF
- Low level exposures - mucous membrane irritation
- Exposures of 700-800 ppm – loss of consciousness and cardiopulmonary arrest
- Concentrations fall off quickly from source

CDPH Investigation 2010

- Lake County Public Health Officer requested assistance of CDPH in Feb - Mar 2010
- CDPH provided information on health affects of H2S including the CA AQS for H2S (30 ppb 1 hour avg.)
- CDPH also provided health messaging information to the PHO to use for public messaging
- CDPH provided a self protective measure to the PHO for residents in the neighborhood to notify the PHO, fire/hazmat, or AQMD if they detect an odor of rotten eggs.

H2S Health Concerns

- California Air Quality Standard (AQS) for H2S is 30 ppb for 1 hour average
- Methane: potential for explosions but high concentrations of CO2 may suppress explosion hazard
- CO2: potential asphyxiation hazard that can easily be detected with a handheld instrument

Officials install equipment to deal with natural hydrogen sulfide leak

Written by Elizabeth Larson
Friday, 12 February 2010

Work continued late Thursday, February 11, 2010, to install a scrubber system off of Division Avenue in Clearlake, Calif., where a natural hydrogen sulfide leak was discovered the previous day. Photo by Elizabeth Larson.

CLEARLAKE – For the last day and a half local health and public safety officials have been working to put safety measures in place in response to a natural hydrogen sulfide leak discovered in a Clearlake neighborhood.

The leak was found in an empty lot off of Division Avenue between Pearl and Uhl avenues late Wednesday, according to Doug Gearhart, Lake County's air pollution control officer.

Work continued throughout the day on Thursday to put equipment in place that would help diminish the problem, Gearhart said.

On Thursday evening, Gearhart and crews were finishing up operations to mitigate the leak, which was giving off a very strong sulfur smell reminiscent of a truckload of rotten eggs.

In addition to Gearhart from Lake County Air Quality Management, officials working to install the equipment and manage the scene included Lake County Fire Protection Battalion Chief Willie Sapeta, Clearlake Police Chief Allan McClain and some of his officers, Environmental Health Director Ray Ruminski, Clearlake Public Works Director Doug Herren, as well as Office of Emergency Services and Lake County Public Health staff.

Ruminski estimated there were eight homes within 200 feet of the leak.

"Nobody's in acute danger at this point," he said.

Hydrogen sulfide is a colorless but highly flammable gas that is emitted by volcanoes and hots springs. An Occupational Health and Safety Administration fact sheet on the gas explains that it is heavier than air and collects in low-lying, poorly ventilated areas, and is both an irritant and an asphyxiant.

Such leaks aren't uncommon in Lake County, which owes its geothermal resources to the volcanic forces

H2S Health Effects

- **0.01 – 0.3 ppm** (10 – 30 ppb) - H2S odor threshold
- **0-10 ppm** - irritation of the eyes, nose and throat
- **10 – 50 ppm** - headache, dizziness, nausea, vomiting, coughing and breathing difficulty
- IDLH is 100 ppm

CDPH Recommendations

- Consider issuing a neighborhood advisory that directs residents to leave the neighborhood if they smell rotten eggs, and to then call the health department, APCO, or fire/hazmat

- Fire or AQMD can then determine if the air levels are below the Air Quality Standards (AQS)

- Return to the area can resume once AQMD determines that air levels are less than the AQS.

H2S Assessment on March 8, 2011

Agencies

- Congressman Mike Thompson's staff
- Clearlake City Council
- Clearlake City Administrator
- Clearlake Public Works
- Lake County APCO
- Lake County Health Services Director
- Lake County Environmental Health Director
- Lake County Public Health Director
- EPA
- START

Site Overview

EPA Assistance

- EPA does not have authority over naturally occurring sources
- EPA provided technical assistance

Assessment – March 8, 2011

- Multi-agency monitoring assessment in neighborhood
  - Monitoring Plan to organize multiple agencies and equipment
  - Occupational levels determined for team
  - Public exposure levels determined – CA AQS

Assessment

- Visible bubbling from ground
- Note school play field in background

Assessment

- Abandoned house due to high H2S

H2S ground level = 150 ppm
H2S breathing height = 41 ppb
LEL = 20 %
O2 = 14.2 %

Assessment

- Burns Valley School Play Field
  1 year old fence

H2S = 180 ppb

Assessment

- Geothermal fumaroles – across street from school

Assessment

- Water utility vault at elementary school

H2S = 0 ppm
LEL = 50 %
02 = 10%

Assessment

- Levels at the school
- Noticeable odor. Concentrations in low ppb.
- School is directly downwind of emitting sources

Assessment

Educational Outreach

All clear

Future scientist !

Assessment

- School grounds – water system

66% LEL

Assessment

- Lake Family Resource Center – across from school

H2S = 53 ppb
LEL =12 %
O2 = 20.9 %

Vapor Extraction System

- Installed last year

Vacant lot in neighborhood

Ambient H2S at street = 2 ppm
O2 = 20.9 %

Site not secure

Assessment

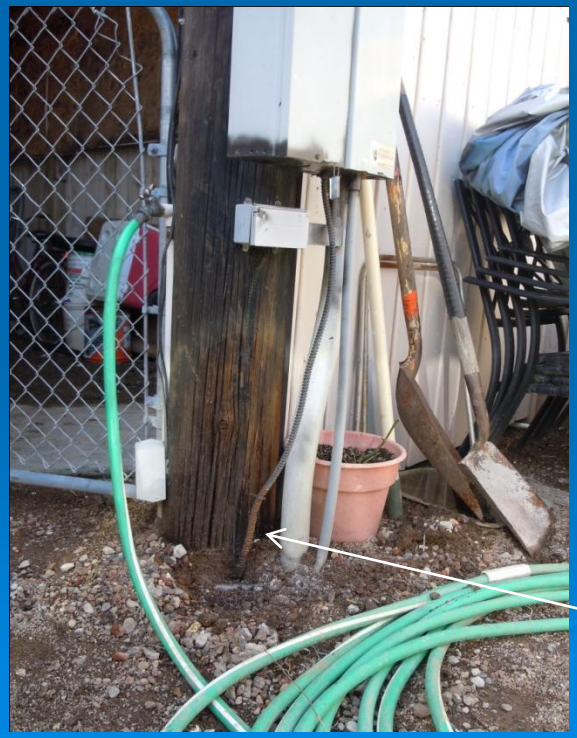
- Pole support wire at mitigation unit (places of ground penetration)

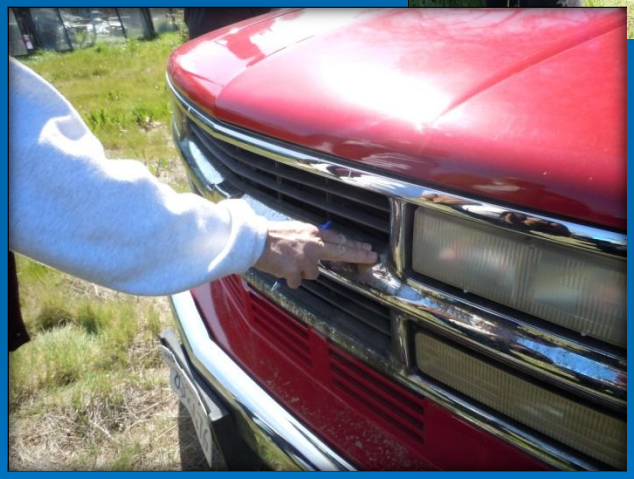
H2S= 100 ppm
LEL = 30 %
O2 = 10 %

Directly across street from neighbors

Assessment

- Neighbor (family) across the street
  - Lost 100 canaries
  - New truck corroded
  - Fruit trees and garden died





Power supply to house corroded.
Property value severely compromised.

Neighborhood

- Area severely economically depressed – low income, education levels
- Potential chronic exposure for residents close to sources and school
- Some residents fear losing their homes if they speak up about odors

Recommendations

EPA and local officials determine next steps

Recommendations

- Apply for DHS grant to expand monitoring program
- Request assistance from CARB Special Purpose Monitoring Program
- Use CARPA Monitoring/Sampling Plan. Also CARPA Response Coordination Guide to establish R & R's and notification protocols
- Establish monitoring network for future – 2-3 sites, inc. continuous monitoring at school
- Develop public notification protocols

Recommendations

- Address Family Resource Center indoor air
- Engage USGS for further study and mapping of fault lines and potential emission vent areas
- Convene weekly multi-agency work group to conduct monitoring, health assessment, and messaging
- PHO Dr. Karen Tait will continue consultation with CDPH and CARPA Data to Message subcommittee – Shelley D. convened a work group to assist Clearlake

Activity Since EPA / USGS Meeting

- Multiagency meetings to develop a Monitoring / Sampling Plan, to discuss recent data collection efforts, and to bring in outside agencies for assistance. (ARB, Waste Board, DPH, etc…)
- Sample collection by various agencies. Hot spot checks, LFRC sampling, and School monitoring. To assist the Public Health Officer in determining risk and setting action levels.
- Setup a monitoring station at the school. Monitoring H2S and CO2 at child breathing level, and Met data with barometric pressure.
- Public Health Officer is working with CARPA Data to Message workgroup to develop public notifications and to prepare for a public meeting.

Neighborhood Monitoring

- Performed walkthroughs of impacted areas, checking for elevated H2S levels.
- Air monitoring inside the Lake Family Resource Center Building
- EH and FPD staff have assisted in monitoring efforts, their equipment is not sensitive enough for ambient concentrations.

Location	1	2	3	4	5	6	7
H2S Conc. (ppm)	0.003	0.006	0.003	0.003	0.006	0.004	0.003

School Monitoring

- ARB Monitoring Assistance
  - Met Station Installed
  - Hydrogen Sulfide Monitoring
  - Carbon Dioxide Monitoring

Monitoring station on school grounds –
Sample inlet at ~3Feet.

Summary

- Overall very positive experience working with CARPA
- CARPA brought together a number of resources and put us in touch with many others willing to provide assistance
- We are in process of developing a sampling and monitoring plan using the CARPA model.
- Our goal is to have a monitoring plan completed, monitoring equipment available, and in place prior to a recurrence of the geothermal gas venting.